

CLAIMS

1. A first adapter to use in a first network node in a network, the first adapter comprising:

circuitry to perform, in response to a first request, a first data storage-related operation associated with a first set of mass storage devices and to issue, also in response to the first request, a second request from the first adapter to a second adapter in a second network node in the network to cause a second adapter to perform, in response to the second request, a second data storage-related operation associated with a second set of mass storage devices.

2. The first adapter of claim 1, further comprising:

circuitry to issue, in response to a first message from the second adapter, a second message to a process in the first network node, the first message indicating that the second data storage-related operation has been completed, the second message indicating that a respective data storage-related operation requested by the first request has been completed.

3. The first adapter of claim 2, wherein:

the second request and the first message each comprise a respective target node address field, initiating node address field, command field, and message identification field; and

respective message identification fields in the second request and the first message contain identical respective values.

4. The first adapter of claim 1, wherein the circuitry and the second adapter each comprise a respective I/O processor.

5. A first adapter to use in a first network node, the first adapter comprising:

circuitry to perform, in response to a request, a data storage-related operation associated with a first set of mass storage devices, the request being issued from a second

adapter in a second network node in response to another request received by the second adapter to cause the second adapter to perform, in response to the another request, another data storage-related operation associated with a second set of mass storage devices.

6. The first adapter of claim 5, further comprising:  
circuitry to issue a first message to the second adapter to indicate that the data storage-related operation associated with the first set of mass storage devices has been completed, and the second adapter is configured to issue, in response to the first message, a second message to a process in the second network node.

7. The first adapter of claim 6, wherein:  
the request issued from the second adapter and the first message each comprise a respective target node address field, initiating node address field, command field, and message identification field; and  
respective message identification fields in the request issued from the second adapter and the first message contain identical respective values.

8. The first adapter of claim 1, wherein:  
the first adapter comprises a first host bus adapter coupled to the first set of mass storage devices;  
the second adapter comprises a second host bus adapter coupled to the second set of mass storage devices; and  
the first adapter and the second adapter are coupled together via a network communication link.

9. The first adapter of claim 5, wherein:  
the first adapter comprises a first host bus adapter coupled to the first set of mass storage devices;  
the second adapter comprises a second host bus adapter coupled to the second set of mass storage devices; and

the first adapter and the second adapter are coupled together via a network communication link.

10. A first input/output (I/O) processor, the first I/O processor being configured so as to able to execute a set of operations comprising:

execution, in response to a first request, of a first data storage-related operation associated with a first set of mass storage devices;

issuance, also in response to the first request, of a second request from a first network node to a second I/O processor in a second network node to cause the second I/O processor to perform, in response to the second request, a second data storage-related operation associated with a second set of mass storage devices.

11. The first I/O processor of claim 10, wherein:

the first network node comprises the first I/O processor and the first set of mass storage devices;

the second network node comprises the second set of mass storage devices; and the first network node and the second network node are coupled together via a network communication link.

12. The first I/O processor of claim 10, wherein:

the second data storage-related operation comprises one or more of the following operations:

designation of a first data volume in a second network node in which data stored in a second data volume in the first network node is to be replicated;

expansion of a size of the target data volume; and

replication in the first data volume of the data.

13. The first I/O processor of claim 10, wherein:

the second data storage-related operation comprises one or more of the following operations:

termination of a previously-established association between a first data volume in the second network node and a second data volume in the first network node, the association designating that data stored in the second data volume is to be replicated in the first data volume; and

re-establishment of the previously-established association after the previously-established association has been terminated.

14. A first input/output (I/O) processor, the first I/O processor being configured to execute a set of operations comprising:

execution, in response to a request, of a first data storage-related operation associated with a first set of mass storage devices; and

issuance, after completion of the execution of the first data storage-related operation, of a first message from a first network node to a second I/O processor in a second network node to cause the second I/O processor to issue, in response to the first message, a second message to a process in the second network node, the second I/O processor being operatively configurable both to generate the request and to perform a second data storage-related operation associated with a second set of mass storage devices, in response to another request from the process.

15. The first I/O processor of claim 14, wherein:

the first set of mass storage devices comprises one or more respective mass storage devices;

the second set of mass storage devices comprises one or more respective mass storage devices; and

the first message is comprised in a frame.

16. A method of using a first adapter in a first network node in a network, the method comprising:

using the first adapter to perform, in response to a first request, a first data storage-related operation associated with a first set of mass storage devices; and

issuing from the first adapter, also in response to the first request, a second request to a second adapter in a second network node in the network to cause the second I/O adapter to perform, in response to the second request, a second data storage-related operation associated with a second set of mass storage devices.

17. The method of claim 16, further comprising:

issuing from the first adapter, in response to a first message from the second adapter, a second message to a process in the first network node, the first message indicating that the second data storage-related operation has been completed, the second message indicating that a respective data storage-related operation requested by the first request has been completed.

18. The method of claim 17, wherein:

the second request and the first message each comprise a respective target node address field, initiating node address field, command field, and message identification field; and

respective message identification fields in the second request and the first message contain identical respective values.

19. The method of claim 16, wherein the first adapter and the second adapter each comprise a respective I/O processor.

20. A method of using a first adapter in a first network node, the method comprising:

using the first adapter to perform, in response to a request, a data storage-related operation associated with a first set of mass storage devices, the request being issued from a second adapter in a second network node in response to another request received by the second adapter, the second adapter being configured to perform, in response to the another request, another data storage-related operation associated with a second set of mass storage devices.

21. The method of claim 20, further comprising:

issuing from the first adapter to the second adapter a first message to indicate that the data storage-related operation associated with the first set of mass storage devices has been completed, the second adapter being configured to issue, in response to the first message, a second message to a process in the second network node.

22. The method of claim 21, wherein:

the request issued from the second adapter and the first message each comprise a respective target node address field, initiating node address field, command field, and message identification field; and

respective message identification fields in the request issued from the second adapter and the first message contain identical respective values.

23. The method of claim 16, wherein:

the first adapter comprises a first host bus adapter coupled to the first set of mass storage devices;

the second adapter comprises a second host bus adapter coupled to the second set of mass storage devices; and

the first adapter and the second adapter are coupled together via a network communication link.

24. The method of claim 21, wherein:

the first adapter comprises a first host bus adapter coupled to the first set of mass storage devices;

the second adapter comprises a second host bus adapter coupled to the second set of mass storage devices; and

the first adapter and the second adapter are coupled together via a network communication link.

25. A method of using a first input/output (I/O) processor, the method comprising:

using the first I/O processor to execute, in response to a first request, a first data storage-related operation associated with a first set of mass storage devices; and

using the first I/O processor to generate, also in response to the first request, a second request that may be issued from a first network node to a second I/O processor in a second network node to cause the second I/O processor to perform, in response to the second request, a second data storage-related operation associated with a second set of mass storage devices.

26. The method of claim 25, wherein:

the first network node comprises the first I/O processor and the first set of mass storage devices;

the second network node comprises the second set of mass storage devices; and

the first network node and the second network node are coupled together via a network communication link.

27. The method of claim 26, wherein:

the second data storage-related operation comprises one or more of the following operations:

designation of a first data volume in the second network node in which data stored in a second data volume in the first network node is to be replicated;

expansion of a size of the first data volume; and

replication in the first data volume of the data.

28. The method of claim 26, wherein:

the second data storage-related operation comprises one or more of the following operations:

termination of a previously-established association between a first data volume in the second network node and a second data volume in the first network node, the association designating that data stored in the second data volume is to be replicated in the first data volume; and

re-establishment of the previously-established association after the previously-established association has been terminated.

29. A method of using a first input/output (I/O) processor, the method comprising:  
 using the first I/O processor to execute, in response to a request, a first data  
 storage-related operation associated with a first set of mass storage devices; and  
 using the first I/O processor to generate, after completion of the execution of the  
 first data storage-related operation, a first message that may be issued from a first  
 network node to a second I/O processor in a second network node to cause the second I/O  
 processor to issue, in response to the first message, a second message to a process in the  
 second network node, the second I/O processor being operatively configurable both to  
 generate the request and to perform a second data storage-related operation associated  
 with a second set of mass storage devices, in response to another request from the  
 process.

30. The method of claim 29, wherein:  
 the first set of mass storage devices comprises one or more respective mass  
 storage devices;  
 the second set of mass storage devices comprises one or more respective mass  
 storage devices; and  
 the first message is comprised in a frame.

31. A network comprising:  
 a first network node associated with a first set of mass storage devices and  
 including a first input/output (I/O) processor;  
 a second network node remote from the first network node, associated with a  
 second set of mass storage devices, and including a second I/O processor;  
 a network communication link coupling the first network node to the second  
 network node;  
 the first I/O processor configured so as to be able to cause the following  
 operations:  
 execution, in response to a first request, of a first data storage-related  
 operation associated with the first set of mass storage devices;



issuance, also in response to the first request, of a second request from the first network node to the second network node via the link to cause the second I/O processor to perform, in response to the second request, a second data storage-related operation associated with the second set of mass storage devices.

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32. The network of claim 31, wherein:

the second I/O processor is configured so as to be able to cause the following operations to be executed:

execution, in response to the second request, of the second data storage-related operation; and

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issuance, after completion of the execution of the second data storage-related operation, of a first message from the second network node to the first network node via the link to cause the first I/O processor to issue a second message to a process in the first network node to indicate a completion of the first data storage-related operation and the second data storage-related operation.

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33. Computer program instructions residing in a computer-readable memory, the computer program instructions comprising a set of instructions that when executed by a first processor cause:

execution of, in response to a first request, a first data storage-related operation associated with a first set of mass storage devices; and

generation of, also in response to the first request, a second request that may be issued from a first network node to a second processor in a second network node to cause the second processor to perform, in response to the second request, a second data storage-related operation associated with a second set of mass storage devices.

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34. The computer program instructions of claim 33, wherein:

the first network node comprises the first processor and the first set of mass storage devices;

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the second network node comprises the second set of mass storage devices; and

the first network node and the second network node are coupled together via a network communication link.

35. The computer program instructions of claim 34, wherein:

the second data storage-related operation comprises one or more of the following operations:

designation of a first data volume in the second network node in which data stored in a second data volume in the first network node is to be replicated; expansion of a size of the first data volume; and replication in the first data volume of the data.

36. The computer program instructions of claim 34, wherein:

the second data storage-related operation comprises one or more of the following operations:

termination of a previously-established association between a first data volume in the second network node and a second data volume in the first network node, the association designating that data stored in the second data volume is to be replicated in the first data volume; and

re-establishment of the previously-established association after the previously-established association has been terminated.

37. Computer program instructions residing in a computer-readable memory, the computer program instructions comprising a set of instructions that when executed by a first processor cause:

execution, in response to a request, of a first data storage-related operation associated with a first set of mass storage devices; and

generation, after completion of the execution of the first data storage-related operation, of a first message that may be issued from a first network node to a second processor in a second network node to cause the second processor to issue, in response to the first message, a second message to a process in the second network node, the second processor being operatively configurable both to generate the request and to perform a

second data storage-related operation associated with a second set of mass storage devices in response to another request from the process.

38. The computer program instructions of claim 37, wherein:

the first set of mass storage devices comprises one or more respective mass storage devices;

the second set of mass storage devices comprises one or more respective mass storage devices; and

the first message is comprised in a frame.

39. A first network node, comprising:

a first processor configured to be able to cause:

execution, in response to a first request, of a first data storage-related operation associated with a first set of storage devices, the first set of storage devices being associated with the first network node; and

issuance, also in response to the first request, of a second request from the first network node to a second network node to cause a second processor in the second network node to perform, in response to the second request, a second data storage-related operation associated with a second set of storage devices, the second set of storage devices being associated with the second network node.

40. The first network node of claim 39, wherein the set of storage devices comprises a set of one or more mass storage devices.

41. The first network node of claim 39, wherein the second network node is remote from the first network node.

42. A first network node, comprising:

a first processor configured to be able to cause the following operations to be executed:

execution, in response to a request, of a first data storage-related operation associated with a first set of storage devices; and

issuance, after completion of the execution of the first data storage-related operation, of a first message from the first network node to a second processor in a second network node to cause the second processor to issue, in response to the first message, a second message to a process in the second network node, the second processor being operatively configurable both to generate the request and to perform a second data storage-related operation associated with a second set of storage devices, in response to another request from the process.

43. The first network node of claim 42, wherein:
- the first set of storage devices comprises one or more mass storage devices;
  - the second set of storage devices comprises one or more mass storage devices;
- and
- the first message is comprised in a frame.